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Objective: To identify moderators of synchrony of change between depression severity and disability.
Method: From a large cohort study with 2 years of follow-up, patients with major depressive disorder at baseline who decreased at least 25% in depression severity after 2 years ($n = 245$) were selected. We measured overall and domain-specific disability at baseline, and at 1- and 2-year follow-up. Possible moderators, among which several demographic, clinical, personality, and contextual factors, were measured at baseline. We used linear mixed models to analyze the data.
Results: Decrease in depression severity correlated strongly with reductions of overall disability ($r = 0.54$). Synchrony of change for the disability domains ranged from 0.13 for self-care to 0.47 for participation. From the possible moderators, only age and work stress moderated the association between change in depression severity and disability, with stronger synchrony of change among younger patients and patients who experienced moderate work stress.
Conclusion: Strong synchrony of change exists between depression severity and disability. Perhaps, because of the strength of this synchrony, few contextual characteristics moderated the association. Clinicians should be aware of the risk of slower or incomplete functional recovery in older people and those without a job or those experiencing low work stress.

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Key words: depressive disorder; major; impairment; risk factors

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Significant outcomes

- Strong synchrony of change between depression severity and disability was found. That is, reductions in depressive symptoms over time were accompanied by reductions in disability.
- However, considerable heterogeneity existed: in some patients, disability did not recover in accordance with their depression severity.
- Age and work stress appeared to moderate the synchrony of change between decreasing depression severity and disability, suggesting that the synchrony of change between decreasing depression severity and disability is stronger among patients of lower age and/or moderate work stress.

Limitations

- Measures we used were merely self-report, so that we cannot rule out potential bias by misrepresentation of self-reported depression severity and disability.
- Analyses were not adjusted for premorbid disability.

Introduction

Major depressive disorder (MDD) is the leading cause of disability worldwide, and its impact on all domains of functioning exceeds the impact of chronic medical conditions (1–4). Previous studies have reported that severity of depressive symptoms is the best predictor for disability among patients with MDD and that depression severity and disability show strong synchrony of change (5–9). That is, reductions in depressive symptoms over time were accompanied by reductions in disability (7, 8). Nevertheless, there are patients in whom reductions of depression severity are not accompanied by equal reductions in disability (10, 11).

This *a-synchrony of change* suggests that, above and beyond the strong effect of depression severity, there may be certain contextual factors that hamper or enhance the effect of decrease in depression severity on disability; under these circumstances, disability does not decrease at the same rate as depressive symptoms. To date, not a single study has focused on moderating effects of personal and contextual characteristics on this synchrony of change or identified groups at risk for postmorbid disability because of a-synchrony of change; in fact, previous studies were limited to direct effects on disability (12–14).

Knowledge about potential moderators is important because it may point to specific groups at risk for high disability during and after depressive episodes and may thus provide new insights into preventing or reducing disability; it may help improve recovery of disability after a depressive episode and may help prevent depression recurrence by tackling harmful characteristics that are associated with disability, given that persistence of disability predicts recurrence of depression (15).

We identified four groups of potential moderators. The first group consists of the demographic factors – age and gender. The second group consists of clinical factors, including the age of onset of depression, whether the depressive episode is a first or recurrent episode, the number of comorbid anxiety diagnoses, and the number of chronic comorbid somatic diseases. The third group represents personality, as expressed in the 'big five' personality traits: neuroticism, extraversion, openness, agreeableness, and conscientiousness. The fourth and last group of factors consists of contextual factors that may moderate the synchrony of change between depression severity and disability: physical activity, household income, education, work stress, social support by partner, and social support by friends. As we are the first to study moderators of synchrony of change between depression severity and disability, it is difficult to formulate detailed hypotheses. Therefore, we consider this study to be explorative.

In sum, the current study will examine synchrony of change between decreasing depression severity and disability in a sample of patients with MDD. Furthermore, we will assess whether moderation of this synchrony of change by several demographic, clinical, personality, and contextual factors is present and if so, in which domain of functioning this occurs. This way we may identify subgroups that are at risk for slower or incomplete recovery of functioning despite their depression reduction.

Aim of the study

Given the importance of knowledge about disability associated with MDD, the aim of the current study is to assess the strength of synchrony of change between decreasing depression severity and disability and its specific domains. Furthermore, we aim to identify characteristics that moderate synchrony of change between depression severity and disability accounting for a-synchrony of change.

Material and methods

Study sample

Data of the patients were derived from the Netherlands Study of Depression and Anxiety (NESDA). NESDA is an ongoing multicenter longitudinal cohort study including 2981 individuals (18–65 years old) with current or remitted depressive and/or anxiety disorder, patients at risk because of family history or subthreshold symptoms, and healthy controls. NESDA's baseline assessment (T0), consisting of both an interview and written questionnaires, included an assessment of demographic and contextual characteristics and a standardized diagnostic psychiatric interview. After 1 year (T1), the patients received a restricted written questionnaire to assess severity of psychopathology, severity of the health consequences of psychopathology, and a number of demographic and contextual characteristics. Two years after the baseline measurement (T2), an extensive face-to-face follow-up assessment was conducted. This assessment was comparable to the baseline assessment. The rationale, objectives, and methods of NESDA have been described previously (16).

In the present study, we included patients with a diagnosis of MDD at baseline who decreased at least 25% in depressive symptom severity at T2

compared with T0. The diagnosis of MDD was based on the Composite International Diagnostic Interview (CIDI) version 2.1. The CIDI is a structured questionnaire with good reliability and validity (17). Current depressive symptom severity was assessed at all three measurements, using the self-report version of the 28-item Inventory of Depressive Symptoms (18). Because we wanted to study moderation of *synchrony of change*, actual change in depression severity was considered necessary. In the majority of patients, depression severity decreased. Therefore, we chose a minimum of 25% decrease in depression severity, which is a commonly used threshold for partial response (19). Partial responders may continue to be symptomatic but are clearly better than at baseline. Furthermore, participation in at least two of the three measurement waves was required. These two inclusion criteria resulted in a study sample of 245. Attrition at the 2-year follow-up of NESDA was very limited and owing to several determinants, as systematically assessed by Lamers and colleagues (20). In our sample, drop-out as a result of a lack of participation in at least two waves was higher among patients of non-North European ancestry ($\chi^2 = 9.7$; $P = 0.00$).

Measurements

Change in disability and depression severity. To measure disability at all time points, we used the total score of the World Health Organization Disability Assessment Score (WHODAS-II; 21). The WHODAS-II has been developed to assess limitations in functioning experienced by an individual in six different domains: communication, getting around, self-care, getting along with people, life activities (i.e., divided into household activities and work activities), and participation in society. To measure general disability, domain scores were combined into a total score ranging from 0 (no disability) to 100 (severe disability). WHODAS-II shows good inter-item reliability (total $\alpha = 0.95$; domains α's $= 0.77$ to 0.93). Two disability change scores were calculated for disability (total and domain scores) and depression severity: change between T0 and T1 and change between T1 and T2.

Demographic factors. Demographic variables that we took into account were age at baseline measurement and gender.

Clinical factors. Various clinical variables were assessed at baseline measurement (T0). Age at the first onset of MDD was assessed using the CIDI. Moreover, we counted the number of past-month diagnoses of several comorbid anxiety disorders (social phobia, general anxiety disorder, agoraphobia, and panic disorder) that were diagnosed based on the CIDI. The presence of chronic somatic diseases was assessed by counting the number of diagnoses of diseases such as heart disease, diabetes, and cancer.

Personality. Neuroticism, extraversion, openness, agreeableness, and conscientiousness, the 'big five' domains of personality, were also included in our study as possible predictors of a-synchrony of change. These were measured using the NEO Five-Factor Inventory [NEO-FFI (22); i.e., short version of the Revised NEO Personality Inventory], which consisted of 60 items.

Contextual factors. Physical activity was measured using the International Physical Activity Questionnaire (23) and expressed in metabolic equivalent of task minutes per week. Household income was assessed in 24 categories, from an income of $<$ €500 a month up to an income of over €5000 a month. Patients were allocated the mean of their income category to create a continuous variable. Years of education were calculated based on the highest level of education a patient completed. By means of the Job Content Questionnaire (24), we assessed whether the working patients experienced stress at work, in line with previous research (14). For each negative answer (i.e., associated with stress at work), the patient was scored one point, while for positive answers, no points were given. By summing up the scores and dividing them by the number of items, we calculated a total work stress score (26 items; $\alpha = 0.81$). This score was subsequently divided into four groups, based on z-scores: no job, low work stress (<-1 SD), moderate work stress (-1 to 1 SD), and high work stress (>1 SD).

Finally, the amount of social support patients received from the partner (if present) and up to two confidants (over 18 years old, no housemates) with whom the patient has close contact on a regular basis was measured. Both social support measures were assessed via the Close Person Inventory (CPI; 25). Because having no partner was quite common while having no confidants was rare, a 'zero' category for partner support was demanded, while this was unnecessary for confidant support. Therefore, we constructed a categorical variable for partner support and a continuous variable for support from confidants. A total of four questions about emotional support, such as 'how often do you trust him/her with your most private problems' were answered with the possibility to give a

maximum of 5 points per item, ranging from no support up to high support. Two separate variables, a partner support and a confidant support variable, were constructed. Partner support was constructed based on z-scores: no partner, low support (< -1 SD), moderate support (-1 to 1 SD), and high support (> 1 SD). Social support by confidants was constructed, by summing up the total points given to each confidant, divided by the number of questions. This resulted in a score ranging from 0 to 10, where a higher score meant higher support.

Statistical analysis

We used linear mixed models (LMM) to study synchrony of change between severity of depression and disability, as well as to determine whether there were moderating effects of several factors on this synchrony of change. LMM can be used to describe a longitudinal relationship between a continuous outcome measure (i.e., disability and its domains) and a predictor (i.e., severity of depressive symptoms) (26) and can, by using change scores, estimate how changes in the main predictor variable affect changes in the dependent variable over time. LMM analysis assumes that individuals deviate randomly from the overall average response. This is extremely useful in relation to our research question, in which we try to explain why most patients show synchrony of change between depression severity and disability, but some do not. Furthermore, LMM is not affected by randomly missing data, and it accounts for correlated repeated data within persons, which is likely to be the case with depression severity, and disability within the same person (27). Hence, LMM treats multiple time points as being nested in one person, and we assume that the errors in change in depression severity between T0 and T1 are related to change in depression severity between T1 and T2 within the same person.

We conducted five separate multivariate LMM analyses for both the general disability score and the domain scores. In all these analyses, change in disability between T0–T1 and T1–T2 (total or domain specific) was the dependent variable. Because we studied synchrony of change in depression severity and disability, change in depression severity between T0–T1 and T1–T2 (Δ depression severity) was the main predictor in all models. The other independent variables differed per model. All study variables, except for change in depression severity and change in disability, were mean-centered to facilitate comparing outcomes of effects of the different variables.

To answer our research question, whether the predictors under study moderate synchrony of change between depression severity and disability, we added interaction terms between change in depression severity and the particular predictor. A significant interaction term indicated that synchrony of change between depression severity and disability was different from the average response for substrata of the predictor under study, i.e., the predictor modified the effect of depression severity. A positive significant interaction effect implicated that higher scores on the moderator were associated with stronger synchrony of change, whereas a negative significant interaction effect implied that higher scores on the moderator are associated with weaker synchrony of change. Strong synchrony of change implies that disability decreases strongly in accordance with depression severity.

We built five models. The first model consisted of, in addition to change in depression severity, demographic factors and their interaction terms with change in depression severity. In the subsequent models, we respectively analyzed the clinical factors (M2), personality (M3), contextual factors (M4), and a parsimonious model with all significant variables from the four models (M5) and their interaction terms with change in depression severity assessed simultaneously. To gather more information on the synchrony of change between depression severity and disability in particular domains, we conducted additional analyses in which we tested moderation of synchrony of change between depression severity and the separate WHODAS-II domain scores.

All predictor variables were entered as fixed factors. Taking the longitudinal design of the study into account, therewith allowing for two change scores for depression severity (T0–T1 and T1–T2), change in depression severity was also added as random factor. An unstructured covariance structure was used, and estimations were based on maximum likelihood. A P-value < 0.05 was considered statistically significant for both the main effects and the interaction effects. Analyses were performed in PASW Statistics 18.

Results

Characteristics of the study population

Mean age of the patients at the baseline measurement was 41.2 years. Over two-thirds of the patients were female (Table 1). The majority was employed (55.1%) and had a partner (66.5%). The minimum decrease in depression severity was 4, whereas the maximum decrease was 45 on the IDS

Table 1. Baseline characteristics of the study population

	Range/categories		
Depression			
Depression severity at T0	15.0–65.0	Mean (SD)	37.5 (10.4)
Depression severity at T1	2.0–54.0	Mean (SD)	23.1 (11.3)
Depression severity at T2	1.0–48.0	Mean (SD)	17.9 (9.0)
Δ depression severity T0–T2	−4.0 to −45.0	Mean (SD)	−19.7 (8.8)
Disability			
General disability at T0	2.8–87.0	Mean (SD)	45.2 (15.2)
General disability at T1	0.0–76.4	Mean (SD)	29.1 (16.6)
General disability at T2	0.0–83.7	Mean (SD)	25.4 (16.5)
Δ general disability T0–T2	−60.9 to 29.4	Mean (SD)	−19.6 (16.8)
Δ disability T0–T2 domain 1: communication	−62.5 to 62.5	Mean (SD)	−18.1 (18.8)
Δ disability T0–T2 domain 2: getting around	−65.0 to 80.0	Mean (SD)	−7.8 (19.9)
Δ disability T0–T2 domain 3: self-care	−50.0 to 43.8	Mean (SD)	−6.9 (14.4)
Δ disability T0–T2 domain 4: getting along	−55.0 to 50.0	Mean (SD)	−13.5 (15.7)
Δ disability T0–T2 domain 5h: household activities	−62.5 to 31.3	Mean (SD)	−15.8 (19.4)
Δ disability T0–T2 domain 5w: work activities	−62.5 to 31.3	Mean (SD)	−22.4 (22.0)
Δ disability T0–T2 domain 6: participation	−65.6 to 40.6	Mean (SD)	−17.7 (16.8)
Demographics			
Age at baseline	18–64	Mean (SD)	41.2 (12.3)
Gender			
Male		*N* (%)	75 (30.6)
Female			170 (69.4)
Clinical variables			
Age of onset MDD	4–61	Mean (SD)	27.3 (13.0)
MDE type (single/recurrent)		*N* (%)	109 (44.5)
			131 (53.5)
# comorbid anxiety diagnoses	0–4	Mean (SD)	1.2 (1.1)
# chronic somatic diseases	0–6	Mean (SD)	1.0 (1.1)
Personality			
Neuroticism	21.0–60.0	Mean (SD)	43.7 (6.7)
Extraversion	13.0–50.0	Mean (SD)	32.6 (6.6)
Openness	24.0–57.0	Mean (SD)	38.0 (6.1)
Agreeableness	28.0–57.0	Mean (SD)	42.4 (5.2)
Conscientiousness	19.0–59.0	Mean (SD)	38.8 (6.8)
Contextual factors			
Physical activity (metabolic equivalent of task minutes)		Mean (SD)	3397.8 (3057.1)
Household income	300–5100	Mean (SD)	2062.0 (1089.8)
Years of education	5–18	Mean (SD)	11.7 (3.3)
Work stress			
No job		*N* (%)	110 (44.9)
Low stress			20 (8.2)
Moderate stress			85 (34.7)
High stress			30 (12.2)
Social support by partner			
No partner		*N* (%)	82 (33.5)
Low support			17 (6.9)
Moderate support			120 (49.0)
High support			25 (10.2)
Social support by confidants	0.0–9.5	Mean (SD)	4.8 (3.2)

scale. Despite this decrease in depression severity in all patients, disability increased in some patients (max. 29.4 on the WHODAS-II scale) but decreased in most others (max. −60.9 on the WHODAS-II scale). For these and more baseline characteristics, see Table 1.

Synchrony of change between depression severity and general disability

Change in depression severity was highly correlated with change in general disability ($r = 0.54$), yet there was considerable heterogeneity between patients (Fig. 1). The explained variance (r^2) of 26% indicated that change depression severity is not the only factor that is associated with change in disability. Correlations between change in depression severity and change in disability varied per WHODAS-II domain ranging from 0.13 for the self-care domain to 0.47 for the participation domain. In particular, the social domains of functioning [communication (0.44), participation (0.47), and getting along (0.37)] were highly correlated with change in depression severity.

There was a strong synchrony of change between depression severity and general disability, indicating

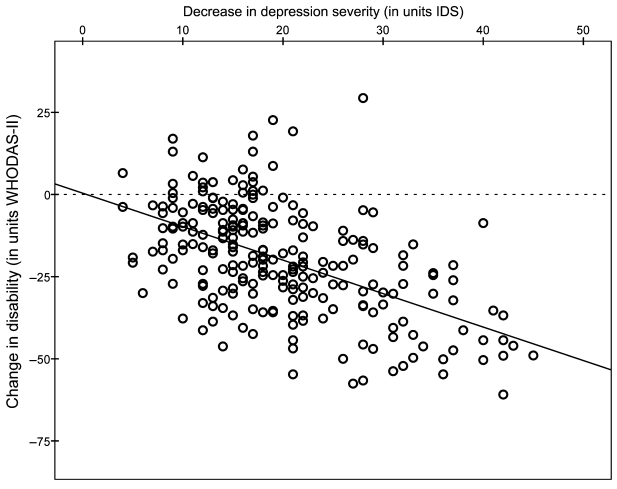

Fig. 1. Decrease in depression severity and change in general disability between T0 and T2, expressed in absolute decrease in depression severity (in units IDS) and change in disability (in units WHODAS-II). Pearson $r = 0.54$.

that a decrease in depression severity was accompanied by a fairly similar decrease in disability (in all models: $B > 0.79$; $P = 0.00$; Table 2). The LMM analyses with interaction terms between change in depression severity and the possible moderator under study (Table 2) indicated that age and moderate work stress moderated the synchrony of change between decreasing depression severity and general disability. This means that the synchrony of change between depression severity and general disability was weaker in older patients, whereas it was stronger in younger patients. Figure 2 illustrates this. Patients who experienced moderate work stress showed significantly stronger synchrony of change than patients without a job. Figure 3 shows that among patients with moderate work stress change in depression severity and general disability are reasonably synchronous. A similar synchrony can also be seen in patients with high work stress, although to a lesser extent. The results with regard to work stress were not biased by a skewed gender distribution, because the percentage of females in both the unemployed and employed group did not differ from the total sample (69.0% females in the unemployed as well as in the employed group). To zoom in on the role of work stress and employment status, we conducted two *post hoc* analyses (results not shown) in which we compared moderate and high work stress with low work stress among patients with a job and compared being employed to being unemployed. The analyses revealed that moderate and high work stress were associated with significantly stronger synchrony of change than low work stress and that being employed was associated with significantly stronger synchrony of change than being unemployed.

None of the other study variables significantly moderated the synchrony of change between depression severity and disability. However, the interaction term of gender was borderline significant ($P = 0.10$), indicating that females tended to show stronger synchrony of change than males. Furthermore, the main effects of the number of comorbid anxiety diagnoses and conscientiousness on change of disability were borderline significant (both $P = 0.07$), indicating that more comorbid anxiety or higher scores on conscientiousness were associated with more change in disability, irrespective of change in depression severity.

Synchrony of change between depression severity and disability per domain

Finally, we examined whether the significant interaction effects that we found were present in all domains of functioning or that some moderators were limited to particular domains. We therefore present the statistically significant results of the parsimonious model (M5) of our analyses with the WHODAS-II domains in Table 3. The strength of the synchrony of change between depression severity and the disability domains varied across domains (Table 3) with relatively less strong synchrony for getting around and self-care (Table 3). The analyses furthermore showed that the statistically significant moderating effects of age emerged for getting around and household activities; the moderating effect of work stress emerged for getting around, household activities, and participation domains (Table 3).

Some variables moderated only specific domains of functioning but did not affect general functioning (Table 3). The synchrony of change between depression severity and getting around and work activities was moderated by gender. Positive regression coefficients indicated that functional recovery lagged behind depression recovery in men, compared with women. Moreover, moderation effects of personality, in particular neuroticism and conscientiousness, were significant in the getting along domain. Negative regression coefficients indicate weaker synchrony of change for higher scores on neuroticism and conscientiousness; more neurotic and conscientious individuals lagged behind with their decrease in disability in the getting along domain. Lastly, physical activity moderated the synchrony of change between depression severity and participation, such that recovery of participation lagged behind the recovery of depression severity in more physically active individuals.

Table 2. Results of linear mixed models analyses for total WHODAS-II score. Main effects of the predictor under study on change in total disability (T0–T1 and T1–T2) adjusted for change in depression severity, and interaction effects of the predictors under study on the synchrony of change between depression severity and total disability (significance $P < 0.05$)

	M1		M2		M3		M4		M5	
	B	*P*	*B*	*P*	*B*	*P*	*B*	*P*	*B*	*P*
Δ depression severity	0.80	0.00	0.96	0.00	0.96	0.00	0.85	0.00	0.79	0.00
Demographics										
Age at baseline	−0.02	0.75							−0.01	0.84
Δ depression × age at baseline	−0.01	0.01							−0.01	0.01
Gender	0.49	0.78								
Δ depression × gender	0.22	0.10								
Clinical variables										
Age of onset major depressive disorder (MDD)			−0.02	0.72						
Δ depression × age of onset MDD			−0.00	0.35						
MDE type (single/recurrent)			−0.23	0.89						
Δ depression × MDE type			−0.00	0.98						
# comorbid anxiety diagnoses			1.43	0.07						
Δ depression × # comorbid psychiatric diagnoses			0.06	0.33						
# chronic somatic diseases			0.57	0.43						
Δ depression × # chronic somatic diseased			0.08	0.17						
Personality										
Neuroticism					0.01	0.94				
Δ depression × neuroticism					0.00	0.91				
Extraversion					−0.18	0.28				
Δ depression × extraversion					−0.01	0.64				
Openness					0.05	0.71				
Δ depression × openness					0.00	0.86				
Agreeableness					0.12	0.50				
Δ depression × agreeableness					0.02	0.11				
Conscientiousness					0.24	0.07				
Δ depression × conscientiousness					0.02	0.15				
Contextual factors										
Physical activity							0.00	0.52		
Δ depression × physical activity							0.00	0.42		
Household income							−0.00	0.98		
Δ depression × household income							−0.00	0.19		
Years of education							−0.18	0.53		
Δ depression × years of education							−0.02	0.44		
Work stress										
No job										
Δ depression × no job							Ref		Ref	
Low stress							−1.21	0.69	−2.10	0.45
Δ depression × low stress							−0.14	0.58	−0.27	0.24
Moderate stress							4.67	0.03	2.87	0.12
Δ depression × moderate stress							0.73	0.00	0.43	0.00
High stress							2.27	0.42	0.66	0.79
Δ depression × high stress							0.43	0.03	0.23	0.19
Social support by partner										
No partner										
Δ depression × no partner							Ref			
Low support							−0.67	0.85		
Δ depression × low support							−0.18	0.50		
Moderate support							−2.59	0.21		
Δ depression × moderate support							−0.27	0.11		
High support							−3.24	0.34		
Δ depression × high support							−0.09	0.76		
Social support by confidants							0.21	0.45		
Δ depression × social support by confidants							0.03	0.15		

Discussion

Main findings

We attempted to explain heterogeneity in disability associated with MDD by assessing factors that could cause a-synchrony of change between decreasing depression severity and disability. To this end, we explored which factors account for the fact that while in most depressed patients disability recovers equally with recovery in depression sever-

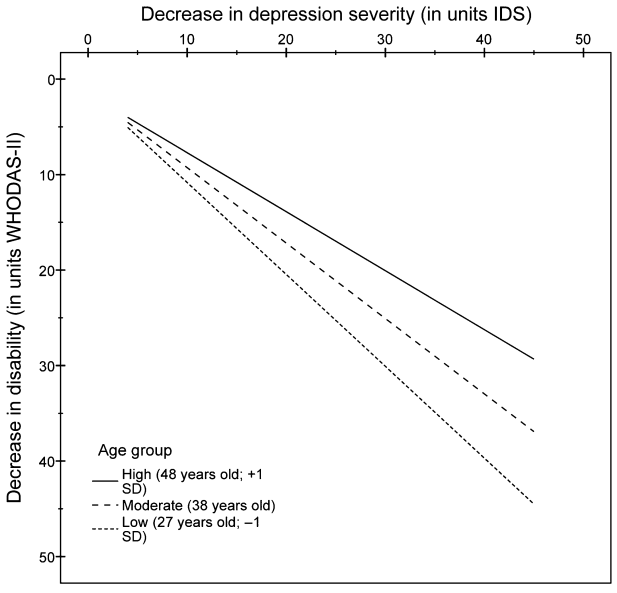

Fig. 2. The decrease of depression severity and disability per age group. Decrease in depression severity is in units IDS whereas decrease in disability is in units WHODAS-II.

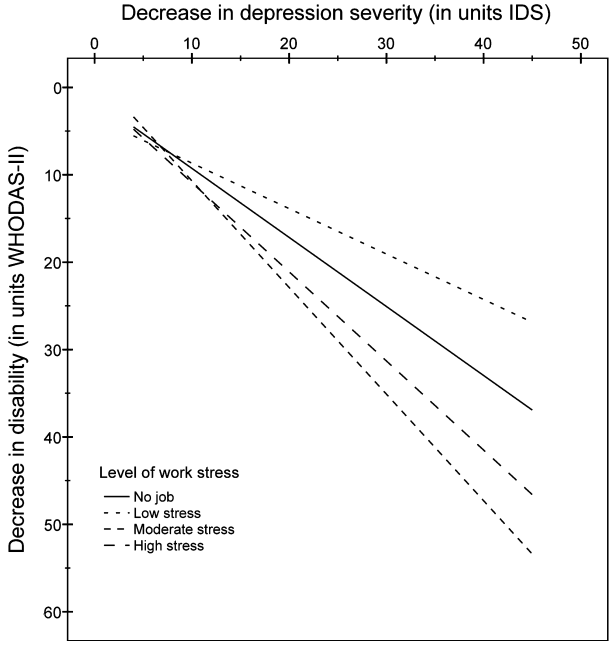

Fig. 3. Course of depression severity and disability separated per level of work stress. Decrease in depression severity is in units IDS whereas decrease in disability is in units WHODAS-II.

ity, in some patients disability does not recover in accordance with the depression severity. As expected, we found a strong synchrony of change between depression severity and overall disability, in particular in the social domains communication, participation, and getting along. Perhaps because of the strong synchrony of change, most personal and contextual variables did not moderate the synchrony of change, except for age and work stress. Older patients and patients without a job showed weaker synchrony of change, indicating that their recovery of disability lagged somewhat behind their recovery of depressive symptoms or that their disability did not recover completely. The effects of age were particularly apparent in the domains of getting around and household activity, whereas work stress played a major role in the domains of getting around, household activities, and participation.

In line with our findings, previous studies showed that being older was a major predictor of disability, with in particular work disability (28), and physical disability (5). However, there are also studies that found no effect of age (12). It is plausible that functioning becomes more difficult with increasing age because of physical impairments that usually accompany getting older. Therefore, recovery of functioning in the domains that are associated with physical impairment (i.e., getting around and household activities) become relatively insensitive to depression severity changes. The domain analyses confirmed that the age effect was mainly present in these domains.

The (initial and *post hoc*) results suggest that (at least) moderate work stress is beneficial for a decrease in disability. Among patients without a job or with low stress, the reduction of disability lagged behind the improvement in depression, or among these patients, the disability did not recover at all. This suggests that the functioning of employed patients benefits more from the improvement of depression than the functioning of unemployed patients. Accordingly, it appears that having a job, and in particular a job that is experienced as causing at least moderate work stress, is beneficial for improving functioning among patients whose depression severity decreases. Because this seems counterintuitive and is in contrast to a previous study (29), replication is essential. Nonetheless, some reasons for the association can be mentioned. First, high demanding jobs may encourage motivation, feelings of responsibility, and give meaning to conduct activities, which forces the patient to regain functioning. Furthermore, having the obligation to go to work may be a driving force for getting out of bed and partaking in normal daily activities. Contact with colleagues may also help to regain functioning because of social support or pressure. Finally, a busy, demanding work life may distract from depressed feelings that may hinder functioning. These reasons for better functioning with higher work stress may also explain the finding that work

Table 3. Significant results of sensitivity analyses per WHODAS-II domain of the parsimonious statistical model (comparable to M5). Main effects of the predictor under study on change in disability per domain (T0–T1 and T1–T2) adjusted for change in depression severity, and interaction effects of the predictors under study on the synchrony of change between depression severity and disability per domain

	Communication		Getting around		Self-care		Getting along		Household activities		Work activities		Participation	
	B	*P*	B	*P*	B	*P*	B	*P*	B	*P*	B	*P*	B	*P*
Δ depression severity	0.84	0.00	0.33	0.01	0.19	0.03	0.40	0.00	0.69	0.00	0.66	0.00	0.76	0.00
Demographics														
Age at baseline			−0.03	0.70					0.07	0.44				
Δ depression * age at baseline			−0.01	0.05					−0.01	0.04				
Gender							0.77	0.66			4.92	0.22		
Δ depression * gender							0.31	0.01			0.80	0.01		
Personality														
Neuroticism							−0.27	0.05						
Δ depression * neuroticism							−0.03	0.01						
Agreeableness														
Δ depression * agreeableness														
Conscientiousness							−0.09	0.46						
Δ depression * conscientiousness							−0.02	0.01						
Contextual factors														
Physical activity													0.00	0.43
Δ depression * physical activity													−0.00	0.04
Work stress														
No job														
Δ depression * no job														
Low stress			−2.35	0.53					−3.15	0.42			−1.83	0.57
Δ depression * low stress			−0.21	0.47					−0.56	0.05			−0.22	0.36
Moderate stress			0.37	0.12					0.31	0.90			1.91	0.38
Δ depression * moderate stress			0.36	0.04					0.30	0.09			0.36	0.03
High stress			0.44	0.89					−0.99	0.77			0.12	0.97
Δ depression * high stress			0.12	0.57					0.03	0.90			0.19	0.33
N	245		245		245		245		245		124		245	

Significance $P < 0.05$.

stress moderates in particular functioning in the participation domain, including the ability of joining community activities, which may be easier for working people. The finding that higher work stress is also associated with stronger synchrony of change in the getting around and household activity domains may reflect confounding by physical disability. Physical disability is likely to negatively influence getting around and household activities. Also, physical disability may make having a job impossible and consequently lead to unemployment.

Sensitivity analyses per domain

Our sensitivity analyses per WHODAS-II domain indicated some predictors of a-synchrony of change in particular domains that were unrelated to general disability. These results should be interpreted with caution because the risk of chance findings may be higher in these analyses. Women appeared to show stronger synchrony of change between depression severity and getting along and work activities than men. Scott and Collings (30) provide two possible explanations for this gender difference: females are more likely to seek treatment than men which, combined with the usually larger social network of females, helps to improve disability associated with depressive symptoms, and primary roles differ between males and females which are differently affected by disability. However, it is unclear why the interaction effect of gender appeared particularly in getting along and work activities and not in the other domains of functioning. The modifying role of neuroticism with regard to getting along is interesting. Neurotic patients show less synchrony of change in this domain of interpersonal functioning compared with their counterparts. It is well known that neurotic people are characterized by chronic interpersonal difficulties (31, 32), which might account for relatively weak synchrony of change in this domain among neurotic patients. The result that higher conscientiousness shows weak synchrony of change is surprising as conscientious people are known for their high levels of self-regulation, persistence, impulse control, achievement orientation, and self-discipline (33). It may be that functioning of highly conscientious patients, owing to these positive features, did not decrease much during the depression so that there is not as much disability to recover from than

among patients with low conscientiousness. The same may be the case among patients with high physical activity. It could be that the functioning of physically active patients was already better than functioning of physically inactive patients, so there is less disability to recover from for patients in the first group. We found, however, no evidence for these explanations, and we cannot rule out chance findings.

Limitations and strengths

Our results and interpretations should be seen in the context of several limitations. Limitations include the use of merely self-reported measures of depression severity and disability. As such, we could not rule out potential bias caused by the misrepresentation of self-reported depression severity and disability. Second, we did not have information of premorbid disability and functioning. This implicates that we have not compared levels of disability during and after the depressive episode to the level of disability before the depressive episode. Adjusting for premorbid disability could have helped to filter out the effects of persons with exceptional levels of disability and may thus have minimized bias in our findings. Consequently, our results should be replicated in future studies.

A major strength of this study includes the longitudinal design, which made it possible to look at relationships between depression severity and disability and moderators of this relation over time. Furthermore, we used an advanced statistical technique that took into account the repeated, correlated measures and was not hindered by missing data.

Implications

Notwithstanding the aforementioned limitations, our findings hold great value for the identification of factors that speed up or complicate recovery from disability in patients with decreases in depression and are, from a clinical point of view, important for several reasons. First, the strong synchrony of change between depression suggests that adequate treatment of depression is indispensable not only to decrease the depressive symptoms but also to prevent or minimize the negative effects of depression on functioning. In line with previous findings, we show that recovery of depression is associated with recovery of functioning and thus decreases contextual and economic burdens of depression (8). Furthermore, we identified subgroups that are at risk of slower or incomplete recovery of functioning, including older depressed patients and depressed patients who have no job or experience low work stress. This information can be used to provide extra care for the persons who belong to these groups. As a final point, our finding that having a job in which the participants perceive moderate or high work stress favors the decrease in disability may imply that it would be valuable to stimulate patients with MDD to remain working. Also, it is tempting to speculate that important and crucial decisions with regard to giving up work should not be made during a depressive episode as this can have consequences for the recovery of functioning. Although depressed patients may be less productive at work, functioning can already benefit from the going to work and regaining normal work life for several reasons that we already mentioned. The positive effect of work stress on a decrease in disability is assumed to be independent of the level of work (i.e., educated or uneducated work), as the amount of perceived work stress can differ per person and work stress can also be experienced by low educated workers with less responsible tasks.

In sum, we identified considerably strong synchrony of change between decreasing depression severity and disability in general and in particular domains of disability. However, this synchrony of change was weaker for depressed patients of older age and for unemployed depressed patients. With these findings, we identified groups that are vulnerable to postmorbid disability. Nevertheless, it should be noted that the current findings also show that depression severity is such a strong predictor of recovery in disability that the impact of other factors is small or limited to a domain of functioning.

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